Modeling of Transformer Winding for Transients: Frequency-Dependent Proximity and Skin Analysis

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Abstract : Precise prediction of dielectric stresses and high voltages of power transformers require the accurate calculation of frequency-dependent parameters. A lack of accuracy can result in severe damages to transformer windings. Transient conditions is stuided by digital computers, which require the implementation of accurate models. This paper analyzes the computation of frequency-dependent skin and proximity losses included in the transformer winding model, using analytical equations and Finite Element Method (FEM). A modified formula to calculate the proximity and the skin losses is presented. The results of the frequency-dependent parameter calculations are verified using the Finite Element Method. The time-domain transient voltages are obtained using Numerical Inverse Laplace Transform. The results show that the classical formula for proximity losses is overestimating the transient voltages when compared with the results obtained from the modified method on a simple transformer geometry.